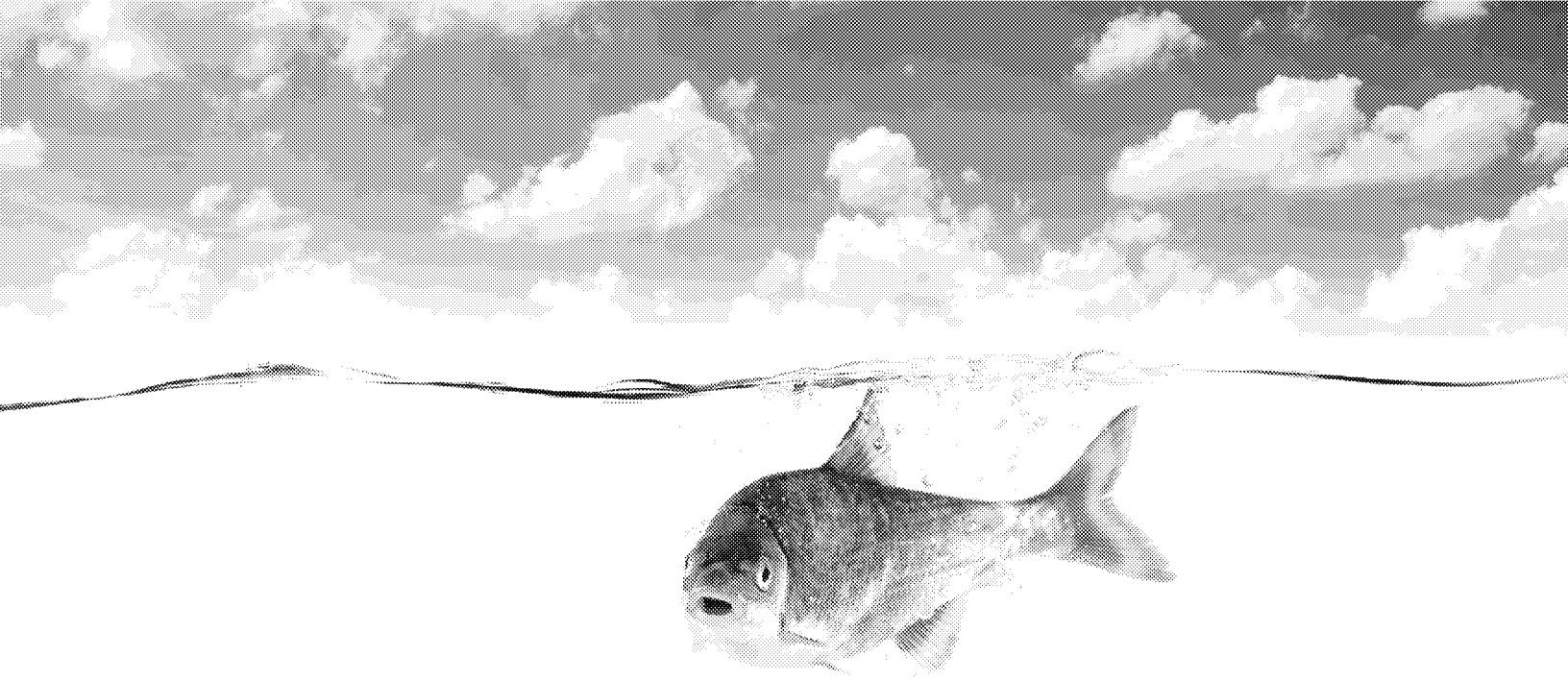


minnow
environmental inc.

Koocanusa Reservoir US 2019
Sampling and Analysis Plan

Prepared for:
Teck Americas Incorporated
Spokane, Washington

Prepared by:
Minnow Environmental Inc.
Georgetown, Ontario

May 2019

Koocanusa Reservoir US 2019
Sampling and Analysis Plan

Tyrell Worrall, M.Sc.
Project Manager

Paul LePage, M.Sc.
Senior Project Advisor

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

Brooks – Brooks Applied Laboratory

COC – Chain-of-Custody

CRM – Certified Reference Material

DELT – Deformities, Erosions, Lesions, or Tumours

DEQ – Montana Department of Environmental Quality

EDD – Electronic Data Deliverable

FWP – Montana Fish, Wildlife, and Parks

GPS – Global Positioning System

GSU – Georgia State University

LCS – Laboratory Control Sample

LKMRWG – Lake Koocanusa Monitoring and Research Working Group

LRL – Laboratory Reporting Limit

MDL – Method Detection Limit

Minnow – Minnow Environmental Inc.

MS – Matrix Spikes

QAPP – Quality Assurance Project Plan

SeTSC – Selenium Technical Sub-Committee

TAI – Teck Americas Incorporated

TMDL – Total Maximum Daily Loads

TTF – Trophic Transfer Factors

Trinity – Trinity Consultants Incorporated

US – United States of America

USACE – United States Army Corps of Engineers

USEPA – United States Environmental Protection Agency

1 INTRODUCTION

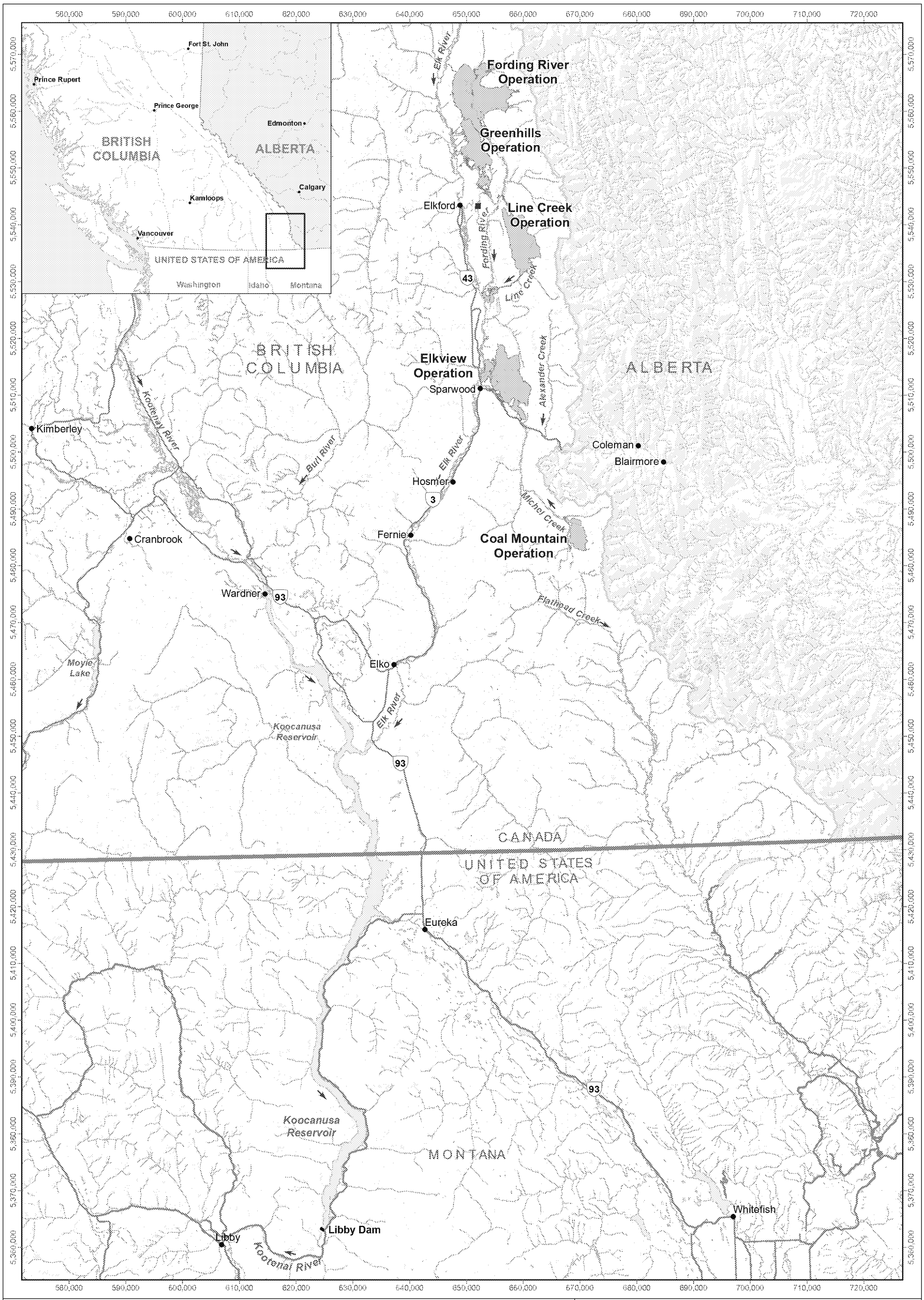
The following document outlines the study plan for the planned collection, analysis, and reporting of monitoring data from the United States of America (US) portion of Koocanusa Reservoir for 2019. Koocanusa Reservoir is formed by the Libby Dam, located 18 miles northeast of Libby, Montana at river mile 221.9 of the Kootenai River (Figure 1). The reservoir is 90 miles long, of which 42 miles is in British Columbia, Canada. The predominant source of water to the reservoir is the Kootenay River, of which the Elk River is a tributary.

This study plan is a component of a larger monitoring program being conducted on the Reservoir by multiple United States, Montana, Canadian provincial agencies, and Teck. The work is being conducted by Teck Americas Incorporated (TAI) and implemented by TAI consultants, Trinity Consultants Incorporated (Trinity) and its subsidiary (Minnow Environmental Incorporated [Minnow]).

Within the US portion of Koocanusa Reservoir, routine monitoring has been conducted annually since 2005 to track Total Maximum Daily Loads (TMDL) for various water quality parameters. This monitoring has been expanded for the purpose of continuing to establish baseline water quality related to management of the reservoir (i.e., Libby Dam operation) and developing a site specific selenium standard for Koocanusa Reservoir (USACE 2019). Also in the US portion of the reservoir, fish tissues have been collected and analyzed for a suite of elements, including selenium, since 2008. Invertebrate tissue sampling was recently initiated (2018) with the objective of establishing Trophic Transfer Factors (TTF) to serve as inputs to a Selenium Ecosystem Model (Montana DEQ and FWP 2018a,b). Sampling in the US portion of Koocanusa Reservoir is led by the US Army Corps of Engineers (USACE; water), the Montana Department of Environmental Quality (DEQ), and Montana Fish, Wildlife and Parks (FWP; fish and benthic invertebrate tissues).

This study plan provides details on the methods and protocols that will be used for collection, analysis, and reporting of fish and invertebrate tissue chemistry and the chemical analysis of particulate selenium in the reservoir. The plan has been developed with input from USACE, Montana DEQ, and Montana FWP. Notably, the sampling locations and methods used in 2019 will closely follow those established previously by Montana DEQ and FWP, and USACE, specifically:

- Montana Fish Wildlife and Parks and Montana Department of Environmental Quality Fish Tissue Quality Assurance Project Plan for Lake Koocanusa (WQSMQAP-02) April, 2018 (Montana DEQ and FWP 2018a);
- Benthic and Surface Macroinvertebrate Selenium Concentrations in Lake Koocanusa Quality Assurance Project Plan (WQSMQAP-01) April 2018, Prepared by Montana



LEGEND

- Libby Dam
- Teck Coal Mine Operation

Teck's Coal Mine Operations Relative to Koocanusa Reservoir

0 10 20 40
km

N W E S

Projection: North American Datum 1983 UTM Zone 11

Date: May 2019
Project 191301.0022

minnow environmental inc.

Figure 1

Document Path: S:\Projects\197202\19xxxx.xxxx - Teck Americas Koocanusa USA\GIS\Study Design Koocanusa USA\19-XX Figure 1 Teck Coal Limited Operation - NEW.mxd

- Department of Environmental Quality and Montana Fish Wildlife and Parks (Montana FWP and DEQ 2018b); and,
- Libby Dam: Kootenai River and Lake Koocanusa Water Quality Sampling and Analysis Plan 2019, USACE, Seattle District, March 2019.

2 PROJECT ORGANIZATION AND SCHEDULE

TAI are working with Montana FWP, Montana DEQ, and USACE to collect and analyze fish, invertebrate, and water samples from Koocanusa Reservoir. For this study TAI and its designated consultant (Trinity / Minnow) has the responsibility of:

- sample plan development;
- coordinating sampling plan methods and sample collection, analysis, and reporting with Montana DEQ, Montana FWP, and USACE;
- collecting, analyzing, and reporting fish tissue and invertebrate tissue chemistry data;
- supporting USACE in the analysis of large volume samples collected during three events in 2019 to determine particulate selenium concentrations; and,
- reporting and communication of results to the multiagency transboundary Lake Koocanusa Monitoring and Research Working Group (LKMRWG) Selenium Technical Sub-Committee (SeTSC).

Sampling components conducted by TAI and/or Trinity/Minnow will be coordinated with Montana DEQ, Montana FWP, and USACE personnel to optimize efficiencies and ensure comparability in sampling locations and techniques. The project will utilize United States Environmental Protection Agency (USEPA) approved laboratories for the chemical analysis of tissue samples. The key groups and their roles applicable to this work plan are as follows:

Teck Americas Incorporated (TAI)

Role: Proponent
501 N Riverpoint Blvd., Suite 300
Spokane, WA 99202
(509) 623 - 4501

Trinity Consultants Inc. (and its subsidiary Minnow Environmental Inc.)

Role: Fish tissue sampling; invertebrate tissue collection, laboratory management and reporting
702 West Idaho Str., Suite 1100
Boise, ID 83702
(208) 472 - 8837

Montana Fish, Wildlife and Parks (Montana FWP)

Role: Collection of fish for fish tissue analysis
1420 E 6th Avenue
Helena, MT 59601

U.S. Army Corps of Engineers, Seattle District (USACE)

Role: Water sample collection and data analysis for large volume sampling
Water Management Section
Seattle, WA 98124
(206) 764 - 5523

U.S. Army Corps of Engineers, Libby Dam (USACE)

Role: Provision of field study storage and processing space for USACE sampling
Libby Dam Project Office
17115 Highway #37
Libby, MT 59923
(406) 293 - 7751

Brooks Applied Laboratory (Brooks)

Role: Water and tissue chemistry analyses
18804 North Creek Parkway, Suite 100
Bothell, WA 98011
(206) 632-6206

Georgia State University (GSU)

Role: Large volume water sample preparation and provision of associated blank material
33 Gilmer Street SE
Sparks Hall, Office 444
Atlanta, GA 30303
(762) 244-3822

Sampling will occur between May and September 2019, with subsequent laboratory analysis, data analysis, and reporting taking up to a further six months following the last sampling event in 2019.

3 SAMPLING GOALS AND OBJECTIVES

Sampling goals and objectives are derived from the previous sampling plans developed by Montana state and US federal agencies:

- analysis of fish tissue to determine selenium concentrations to continue baseline monitoring of fish tissue selenium at Koocanusa Reservoir, support ongoing trend analysis by Montana FWP (compare to 2008 and 2013 as well as other data collected in Canada), and inform a site-specific selenium criterion/objective for Koocanusa Reservoir;
- collection and analysis of surface and benthic invertebrate tissues to determine selenium concentrations to continue baseline monitoring, support the evaluation of trends, and inform selenium ecosystem models contributing to the derivation of a site-specific selenium criterion/objective for Koocanusa Reservoir; and,
- analysis of particulate selenium concentrations to support USACE in maintaining adequate information on the physical, chemical, and biological condition of Koocanusa Reservoir and the Kootenai River from which potential future changes can be assessed.

4 SAMPLING PLAN AND PROCEDURES

4.1 Sampling Plan

The sampling plan to meet the objectives stated above is consistent with the Quality Assurance Project Plans (QAPP) developed by Montana DEQ and FWP (2018a,b) and the USACE (2019) sampling plan. Sample sites and sampling frequency have been selected consistent with previous sampling, reservoir morphometry, effects of reservoir drawdown, and political boundaries. Water levels in Koocanusa Reservoir are generally lowest in late winter/early spring (i.e., February through April) and highest in summer/early fall (Minnow 2018a). The reservoir has previously been divided by Montana FWP into three areas, including Canada, Rexford, and Tenmile areas.

Fish sampling has previously been conducted in all three areas of the reservoir by Montana FWP. In 2019, Montana FWP are resampling the Rexford area in May and September and will provide fish for the tissue chemistry analysis component. For invertebrate sampling, Chisholm et al. (1989) found that all areas of the reservoir were similar with respect to types of invertebrates caught in surface tows, and over the various months of collection. For the collection of surface and benthic invertebrates in 2019 for selenium analysis, the SeTSC suggested that the invertebrate collections occur as close temporally and spatially to the 2018 fish collection locations as possible. Therefore, the benthic and surface invertebrate collections will occur in 2019 at the same spatial areas as the fishing nets set at the Rexford and Tenmile sites, and as close temporally (within two weeks) to the fish collections as possible. A summary of the sampling program is included in the following table.

Sample Medium / Constituent	Frequency	Sites	Study Plan / Sample Collection	Shipping / Laboratory Analysis	Data QA, reporting and upload
Particulate Selenium	Three per year (May, July and Sept)	LIBBOR and LIBFB (Border and Forebay) – two depths at each site	USACE	TAI	USACE
Fish tissue	May and Sept	Rexford - up to 14 nets	MT FWP and TAI*	TAI	TAI
Invertebrate tissue	May and Sept	Rexford and Tenmile – 8 stations at each	TAI	TAI	TAI

*Fish collection will be conducted only by Montana FWP, and not TAI.

Sampling, analysis, and reporting procedures will generally follow study plans developed by US and Montana agencies (Montana DEQ and FWP 2018, USACE 2019). The Rexford and Tenmile sampling areas are shown in Figure 2. The figure identifies primary sample sites, based on 2018 highest gillnetting fish catches by Montana FWP, where surface and benthic invertebrate sampling will be conducted by TAI. Secondary, reserve, sites are noted as where 2018 fisheries sampling occurred (gillnetting) but are not planned to be used for sampling in 2019.

4.2 Sampling Procedures

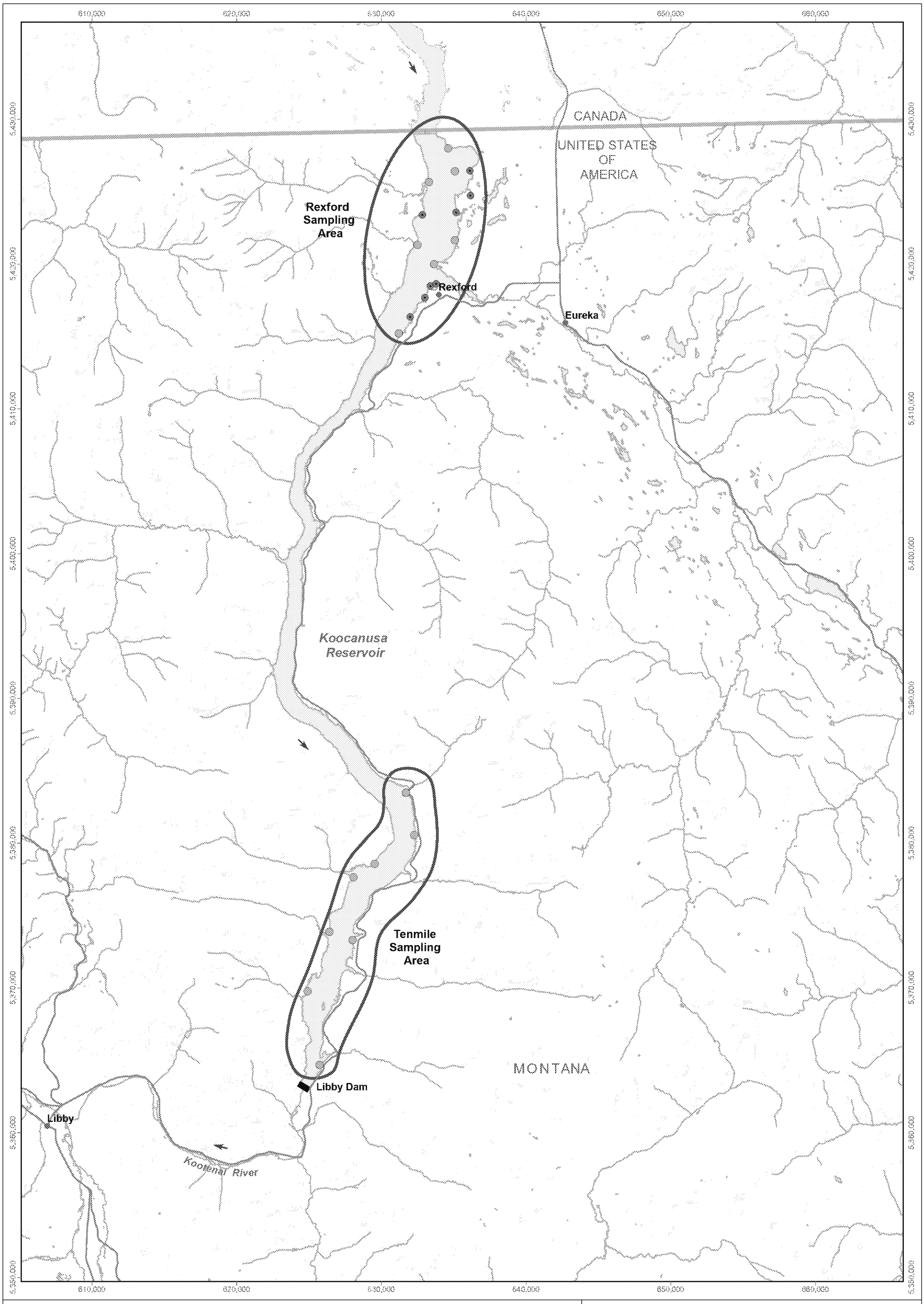
4.2.1 Fish Tissue Sampling

Fish collection will be conducted by Montana FWP, in general alignment with the 2018 Fish Tissue QAPP (Montana DEQ and FWP 2018):

- gillnets will be set at Rexford sites in the spring and fall (mid-May and mid-September 2019) for soak periods of approximately 24 hours; electrofishing maybe used for small-bodied fish collection;
- gillnetting stations used in 2019 will be consistent with previous sampling (e.g., 2018);
- Montana FWP will inventory, identify, and process fish consistent with their sampling requirements and provide fish to TAI for further processing and tissue sample collection; and
- fish processing for tissue sample preparation will target eight (8) individuals (except northern pikeminnow where 15 individuals will be targeted in spring) of each species (where numbers allow) with a preference for the sampling of mature females.

Fish tissue sample preparation will be completed by Minnow/Trinity and generally follow the QAPP (Montana DEQ and FWP 2018a). Fish will be processed in the field proximal to the Rexford sample site/boat launch. Measures will be taken to avoid contamination of tissues from unintended sources (e.g., away from vehicle exhausts; crews will wear nitrile gloves during processing). Between fish, the processing knife/board will be cleaned. Field processing of fish will include:

- recording the sampling site, date, species, length (total and fork, in millimeter [mm]), and weight (in g), the latter of which will be measured using appropriately-sized spring scales (fish greater than 50 g) or a digital balance (± 0.001 g; fish less than 50 g; if fish measurement data [e.g., length and weight] is provided by Montana FWP, this information will be used);
- recording of internal or external deformities, erosions (fin and gill), lesions, or tumours (DELT) observed during processing (Sanders et al. 1999) and parasites;



LEGEND

- Reserve Station
- Primary Station
- Sampling Area

Koocanusa Reservoir Fish and Invertebrate Tissue Monitoring Study Areas and Stations

0 4 8 16
km

N W E S

Projection: North American Datum 1983 UTM Zone 11

Date: May 2019
Project: 191301.0022

minnow environmental inc.

Figure 2

Document Path: S:\Projects\197202\19xxxx.xxxx - Teck Americas Koocanusa USA\GIS\Study Design Koocanusa USA\19-XX Figure 2 Koocanusa Reservoir USA Sampling Areas.mxd

- collection of age structures, including otoliths, pectoral fin rays, and/or scales (as appropriate for each fish species) from each fish sampled for tissue chemistry with a preference for otoliths. Each age structure will be wrapped separately in waxed paper, placed inside a labelled envelope, and then dried or frozen in preparation for laboratory age determinations;
- dissection to determine the sex and/or sexual maturity of each fish sampled for tissue chemistry, and from these fish, whole gonads and livers will be removed and weighed to the nearest milligram using an analytical balance with a surrounding draft shield; and,
- collection of a boneless muscle fillet sample from each fish using clean implements and, for females with sufficient gonad development (i.e., spring spawners in May/fall spawners in September), whole ovaries retained for tissue analysis. Following removal, these tissues will be placed individually in separately labelled polyethylene (Whirl-Pak®) sample bags, put on ice, and subsequently frozen.

In the event that gonads are not sufficiently developed for females of a species (i.e., eggs not able to be visibly differentiated), males, and/or females of the species will be sampled for muscle and aging tissues. Tissue samples for chemical determinations (i.e., ovaries, muscle) will be kept at temperatures below 4 °C (in the field) and stored frozen prior to shipment to the respective laboratory for analyses (Brooks). Field duplicates shall be collected on a minimum 10 % of all muscle and gonad tissue samples collected. The duplicates will be created by splitting the respective tissue sample into two samples.

4.2.2 Invertebrate Tissue Sampling

Invertebrate tissue sampling will be conducted in general alignment with the 2018 QAPP (Montana DEQ and FWP 2018b), which will include:

- sampling in May and September 2019, consistent with fish sampling timing/location, reservoir stage (rising/falling), and 2018 sampling methods;
- sampling the same locations at Tenmile and Rexford areas of Koocanusa Reservoir, up to a maximum of eight (8) stations at each location, as per the 2018 QAPP with preference given to the stations at which highest catches of fish occur from gillnets set in 2018 for the Rexford sites (primary stations in Figure 2); and,
- sampling for surface and benthic invertebrates at each station.

Surface invertebrate samples will be collected at each station using a tow net, consistent with 2018 sampling. The dimensions of the surface tow net will be 1.0 m wide by 0.3 m high opening and tapering to a 100 mm diameter collar to which a plastic receptacle (cod piece) outfitted with 80 µm mesh is placed. The walls of the net have been constructed using 3.17-mm mesh near

the mouth and 1.59-mm mesh in the midsection leading to the net collar. At each station, the net will be towed a distance of up to approximately 600 m with the net mouth half submerged at the water surface, and towed outside of the boat wake. Supporting information taken for each tow will include Global Positioning System (GPS) coordinates at the beginning and end of the tow distance. Shoreline tows will be made in a zig-zag pattern. Sampling will target the collection of approximately 2 to 10 g of invertebrate tissues at each station. Reasonable effort will be applied to collect the target amount of invertebrate tissue using surface tows, including the use of additional surface tows at each station. In the event sample collection is not possible as planned, the timing of subsequent surface tow sampling required to collect sufficient sample will be based on coordination with regulatory agencies, water temperature, and/or reservoir stage.

Following the tow, the contents of the net will be placed in a white tub, and invertebrates will be removed from the material using fine-point forceps, placed into sterile cryovials, and put on ice (while in the field). Invertebrates will be separated into aquatic and terrestrial invertebrates for selenium analysis. If there are more than one type of invertebrates from the surface tows, they will be sorted as much as possible while still achieving the necessary mass (2 g minimum) for selenium analysis. A minimum of one replicate sample will be collected from each sample site and where sample weight allows a minimum of one duplicate sample will be analyzed. General notes regarding invertebrate types, including classification to phyla, order, or family level, will be recorded for each sample. No further taxonomic analysis will be conducted on the samples. Samples will be stored on ice while in the field, and later frozen upon return from daily field sampling events. At the completion of each respective sampling event, the surface invertebrate samples will be shipped to Brooks for selenium analysis.

Benthic invertebrate grabs will occur in the same station locations as the surface invertebrate tows. Benthic invertebrates will be collected at each station using a stainless steel Petite Ponar dredge sampler. A single composite sample will be created from a minimum of four Petite Ponar grabs collected at each station (i.e., 8 stations at Rexford and 8 at Tenmile areas). The composite sample will be field-sieved using 500 µm mesh. Material retained by the 500 µm mesh will be transferred to a white tub for removal of benthic organisms using fine-tipped forceps. Visible organisms removed from the debris/sediment will be rinsed clean using ambient water. Similar to sampling conducted on the Canadian side of Koocanusa Reservoir, larvae of non-biting midges (Diptera family Chironomidae) will be targeted for tissue collection, but if chironomids are not present in sufficient numbers, other benthic invertebrates may also be included/compose the sample (Minnow 2018a,b). Sampling will be conducted in this manner until approximately 0.5 g of invertebrate tissues are collected for the station. In the event that sufficient material is not collected in the four-grab composite, additional grabs will be taken and sieved according the methods outlined above until the target mass of invertebrate tissue is collected. The benthic

invertebrates will be placed into sterile cryovials, put on ice (while in the field), and subsequently frozen.

General notes regarding invertebrate types, including classification to phyla, order, or family level, will be recorded for each sample. No further taxonomic identifications will be conducted. Additional supporting information taken at each benthic invertebrate tissue sampling location will include GPS coordinates and sampling depth. Where sufficient sample allows, tissue will be split to create a duplicate. At the completion of each respective sampling event, the benthic invertebrate samples will be shipped to Brooks for selenium analysis.

4.2.3 Large Volume Water Sampling

Large volume sampling will be conducted by the USACE, consistent with the procedures outlined in USACE (2019) for the particulate selenium analysis. Sampling will occur as outlined below:

- samples will be collected at two sites - LIBBOR (border) and LIBFB (Forebay – immediately upstream of the Libby Dam);
- two depths will be sampled based on the physical structure of the water column; a sample from the epilimnion (EPI) and hyoplimnion (HYPO);
- sampling events are planned for May, July and September, with the exact timing determined by the USACE based on field conditions/reservoir stage targeting both the rising and falling water levels; and
- samples will be stored on ice at about 4 °C in a cooler and transported to the laboratory within 48 hours of collection. A chain-of-custody (COC) record will accompany the samples that clearly identifies the analytical parameters and methods.

TAI will provide logistical support for each of the three sampling events including:

- provision of pre-cleaned 19 L HDPE carboys;
- powdered Weisner Quartzite (provided by the analytical laboratory (GSU));
- blank water (deionized water (provided by the analytical laboratory [GSU]); and
- shipping and analytical laboratory support (defined in subsequent sections).

4.3 Analytical Procedures

4.3.1 Fish Tissues

Fish tissue for chemical analysis will be completed by a certified laboratory (Brooks) consistent with 2018 studies (Montana DEQ and FWP 2018a) and in consideration of EPA820-F-16-007. Analysis will be conducted for moisture content (ASTM D2974A modified dry 60-65 °C), digested (USEPA method 3050) and analyzed for metals (including arsenic, cadmium, copper, lead,

and selenium) by ICP-MS (method WS6020) with results reported in dry weight. The target detection limit for determination of selenium concentrations will be 0.5 µg/g dry weight or lower.

Fish tissues collected for age analysis will be submitted to a qualified laboratory for analysis (e.g., AAE Technical Services in Winnipeg, Manitoba). Otoliths will be prepared and read under a compound microscope using transmitted light. For each structure, the age and edge condition will be recorded along with a confidence rating for the age determination.

4.3.2 Invertebrate Tissues

Surface and benthic invertebrate tissue samples will be shipped to a qualified laboratory (Brooks) for analysis of moisture content and selenium concentrations. The required reporting value for tissue selenium is not to exceed 0.1 µg/g with a method detection limit of 0.06 µg/g assuming a 1 g sample. Percent solids of 0.5% and 0.34% will be used for the reporting value and lab detection limit, respectively. Selenium concentrations will be reported on a dry weight basis, but moisture content will also be reported to allow conversion to wet weight values, as required.

4.3.3 Large Volume Water Sampling

Large volume water sample analysis will be conducted by Georgia State University (GSU) and Brooks Laboratories as outlined in USACE (2019). Samples will be shipped by USACE overnight to the GSU lab for particle extraction and freeze drying. After particle extraction, the dried particulate samples will be shipped to Brooks for total selenium analysis. Analysis by Brooks will follow USEPA method EP1638 using a detection limit of 0.06 mg/kg. These methods provide detection limits that are below US state and federal regulatory criteria or guidelines, enabling the direct comparison of analytical results with these criteria. The holding time for these samples, provided the sample temperature is kept below 4°C, is six months. The laboratory will report the analytical results within 30 days of receipt of the samples. Sample and quality control data will be reported in a standard format. The reports will also include a case narrative summarizing any problems encountered in the analyses.

4.4 Data Quality Objectives, Assurance, and Control

4.4.1 Overview

The Data Quality Objectives for the project, summarized in the table below, are consistent with other associated study plans (e.g., QAPP and Minnow 2018a). Data failing to meet these objectives will be flagged or rejected. Accuracy is the degree of agreement of a measurement with a known or true value. Measures of accuracy include calibrations (accuracy over a range of values), laboratory control samples (LCS) and sample specific controls such as

Quality Control Measure	Sample Control Sample Type/Check	Fish Tissue Chemistry	Invertebrate Tissue Chemistry
Sample handling	Comparison of hold time and temperatures on shipping/sample receipt	Exceedances of hold times and temperature will be flagged in the results	
Analytical Reporting Limits	Comparison of reporting method detection limits (MDL) to target and analytical results	Each MDL by parameter should be at least as low as applicable guidelines, ideally ≤1/10th guideline value	
Blank Analysis	Field Blank	n/a	n/a
	Laboratory Blank	n/a	n/a
Precision	Laboratory duplicate – 10 % of sample analysis	RPD is ≤30%*	RPD is ≤30%*
	Field duplicate – 10 % of samples collected (if sample volume allows)	RPD is ≤30%*	RPD is ≤30%*
Accuracy	Laboratory control sample	75-125%	75-125%
	Matrix spike	75-125%	75-125%
*If within 5 times MDL then duplicate pairs should be within +/- 50%; if duplicates fail this criteria – data flagged as estimate			

matrix spikes (MS) and certified reference materials (CRMs). Laboratories are responsible for method accuracy in initial and continuing calibrations in accordance with the analytical method requirements.

4.4.2 Fish Tissues

Field sampling will be conducted by staff trained and experienced in comparable programs. A field review of this plan will be conducted. Field data will be recorded on field forms consistent with the 2018 QAPP (Montana DEQ and FWP 2018a,b) as well as standard forms to support the additional data collected in 2019 (i.e., abnormality and dissection information). All equipment will be calibrated as per the manufacturer requirements and at the recommended frequency. Fish length and weight measurements will be collected using standard measuring boards and balances, respectively, the latter of which will be calibrated prior to use and checked at least once each day with reference weights. Chain-of-custody (COC) forms will be filled out to achieve traceability of samples from the field to the laboratory. Field duplicates will be collected on 10%

of all muscle and gonad tissue samples collected. The duplicates will be created by splitting the respective tissue sample into two samples. The analytical laboratory will report, within 30 days of sample receipt, the method, hold time, blank results, detection limits, laboratory duplicate results, matrix spikes, control standard information, and sample/field duplicate results.

For fish aging structures, approximately 10% of samples will be assessed by a second individual at the laboratory.

4.4.3 Invertebrate Tissues

Field sampling will be conducted by staff trained and experienced in comparable programs. A field review of this plan will be conducted. Field data will be recorded on field forms consistent with the 2018 QAPP (Montana DEQ and FWP 2018a,b) as well as standard forms to support the additional data collected in 2019 where required. All field sampling and analytical equipment will be maintained in working condition. Backup equipment or spare parts will be on hand whenever possible. All equipment will be maintained as per the manufacturer recommended instructions. COC forms will be filled out to achieve traceability of samples from the field to the laboratory. All sample batches from each project (site) will be run with an equipment blank (one per every ten samples or per project), a standard reference material, a lab and field duplicate (if possible), and a matrix spike and blank spike.

4.4.4 Large Volume Water Sampling

Field measures will be taken for quality control and assurance by USACE consistent with the sampling plan (USACE 2019). A particulate selenium recovery standard/field blank will be made every time large volume samples are collected and delivered to Georgia State University. Recovery samples/field blanks will be prepared by adding 3.00 g of powdered Weisner Quartzite (provided by Georgia State University) to a decontaminated 19 litre HDPE carboy filled with certified blank water (deionized water). This sample will be shipped together with the large volume samples to Georgia State University where it will be used to determine the recovery of suspended sediment during the continuous centrifugation. A field blank will be assessed to determine contamination during the centrifugation, handling, and shipping of the samples. Selenium results from the recovery standard will be compared to selenium results from the Weisner Quartzite alone (dry, not subjected to centrifugation) to determine the field blank. The analytical laboratory will report, within 30 days of sample receipt, the method, hold time, blank results, detection limits, laboratory duplicate results, matrix spikes, and control standard information. Laboratory reports will be interpreted by USACE (USACE 2019).

5 DATA ANALYSIS AND MANAGEMENT

For fish and invertebrate tissue results, the data will be reported in three stages:

- initial preliminary review of data and communication to the SeTSC of selenium tissue concentrations;
- field and data report including data analysis; and,
- upload into Montana databases; Electronic Data Deliverables (EDDs) will be prepared following the guidance provided by the MT-eWQX Guidance Manual available from the Water Quality Planning Bureau's WQX webpage:

  https://deq.mt.gov/Portals/112/Water/WQInfo/Documents/datamgmt/Step_1/MT-eWQX_GuidanceManual.pdf

Field and data reporting for fish and invertebrate sampling / analysis will document field sampling and laboratory results. Data acceptability will be reviewed, relative to the data quality objectives, and results presented with summary statistics provided. Data interpretation may include comparison to relevant guidelines, and where appropriate and/or when the required data are available, examination of potential relationships between selenium concentrations and various endpoints for the different tissues.

The large volume water sampling laboratory reports will be distributed to USACE and TAI, consistent with chain-of-custody forms. TAI will review the results to confirm that the required laboratory information is present. Data management, review, storage, acceptability, analysis, and reporting will be conducted by USACE.

6 REFERENCES

Chisholm et al, 1989. Quantification of Libby Reservoir Levels needed to maintain or enhance reservoir fisheries. Methods and Data summary, 1983-1987.

Minnow. 2018a. Koocanusa Reservoir Monitoring Program Study Design, 2018 to 2020. Prepared for Teck Coal Limited, Sparwood, BC. Project No. 177202.0048. April 2018.

Minnow. 2018b. Koocanusa Reservoir Monitoring Report, 2014 to 2016. Prepared for Teck Coal Limited, Sparwood, BC. Project No. 167202.0049. January 2018.

Montana DEQ and FWP. 2018a; Montana Fish Wildlife and Parks and Montana Department of Environmental Quality. Fish Tissue Quality Assurance Project Plan for Lake Koocanusa (WQSMQAP-02) April, 2018;

Montana DEQ and FWP. 2018b. Montana Fish Wildlife and Parks and Department of Environmental Quality. Benthic and Surface Macroinvertebrate Selenium Concentrations in Lake Koocanusa (Quality Assurance Project Plan) (WQSMQAP-01) April 2018.

Sanders, R.E., R.J. Miltner, C.O. Yoder, and E.T. Rankin. 1999. The use of external deformities, erosion, lesions, and tumors (DELT anomalies) in fish assemblages for characterizing aquatic resources: A case study of seven Ohio streams. In: T.P. Simon (Ed.), pp: 225-246, Assessing the sustainability, and biological integrity of water resources using fish communities. CRC Press, Boca Raton, FL.

USACE (United States Army Corps of Engineers). 2019. Libby Dam: Kootenai River and Lake Koocanusa Water Quality Sampling and Analysis Plan 2019. U.S. Army Corps of Engineers, Seattle District, March 2019.